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AUTHORITY

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U. S. ARMY TEST AND EVALUATION COMMAND
COMMODITY ENGINEERING TEST PROCEDURE

# BREATHING APPARATUSES, SELF-CONTAINED AIR/OXYGEN SUPPLY

## 1. OBJECTIVE

The objective of this Materiel Test Procedure (MTP) is to establish a uniform procedure for determining and evaluating the technical performance and safety aspects of self-contained air/oxygen supply breathing apparatuses in terms of the criteria established by applicable Qualitative Materiel Requirements (QMR), Small Development Requirements (SDR), Technical Characteristics (TC), and other design requirements and specifications. These procedures will also permit evaluation of the relative safety of test items in the hands of Army troops and the safety of items for service testing.

## 2. BACKGROUND

Self-contained breathing apparatuses are portable respiratory protective devices which supply respirable air to the wearer from self-contained air or oxygen supplies without recourse to the surrounding atmosphere. They are intended to protect the wearer in oxygen-deficient atmospheres or in vapors or gases which do not poison by skin absorption.

Breathing apparatuses are classifiable by type, class, and style as follows: (See reference 4A (30 CFR 11).)

a. Types--according to their intended use:

1) Apparatus for entry into or escape from hazardous areas
2) Apparatus for escape only from hazardous areas

b. Classes and styles--according to design principles:

1) Closed-circuit (or recirculating) apparatus--supplies breathing gas to the wearer from either a cylinder of compressed or liquefied gas or a canister containing oxygen-generating materiel.

a) With compressed-oxygen supply
b) With oxygen-generating capability
c) With liquid-oxygen supply

2) Open-circuit apparatus--supplies breathing gas to the wearer without provision for recirculation. The gas is admitted to the facepiece through a pressure reducing mechanism, either on demand or by maintaining a positive pressure in the facepiece at all times.

a) Demand style

b) Pressure-demand style

3) Combination of closed-circuit and open-circuit apparatus--convertible from one operating mode to the other as required by circumstances.

Breathing apparatuses are life-support systems essential to the survival of their wearers, so their technical performance and safety aspects cannot be considered separately. Measurement of the technical performance and evaluation of self-contained breathing apparatuses can be divided into a number of separate subtests as described in the following procedures. Some of these subtests may be omitted as inapplicable to some test items, depending on the technical requirements established by the design requirements.

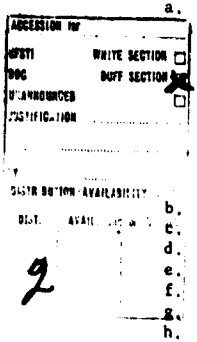
The self-contained breathing apparatus has no limitations as regards the concentration of gas, particulate matter, or oxygen level in the atmosphere in which it is worn. When it is used in the presence of skin-irritating gases and such gases as hydrocyanic acid gas, which can be absorbed in dangerous or lethal amounts through the unbroken skin, suitable measures must be employed to protect the individual against these hazards.

The length of time that the wearer may remain in a contaminated atmosphere depends on the amount of oxygen or air made available to him by the apparatus and upon his activity. The self-contained breathing apparatus is rated according to whether it will protect for 4 hr., 3 hr., 2 hr., 1 hr., or 1/2 hr. while moderately heavy work is being done. QMR's, SDR's, or other technical requirements will indicate the operating limit of each particular air breathing system that is under consideration. For a list of currently approved self-contained breathing apparatuses and information on their proper selection, use, and care, see reference 4C (TB MED 223).

3. REQUIRED EQUIPMENT

a. Environmental Test Chambers:

1) Temperature and humidity
2) Fungus
3) Dust
4) Solar radiation
5) Water immersion
6) Salt fog
7) Rain




b. Nitric Acid
c. Calibrated Pressure Gage (0-3000 psig)
d. Applicable Gas or Suitable Substitute as required
e. Thermocouple and Recording Equipment
f. Aircraft or Simulated Aircraft
g. Still and Motion Picture Photographic Equipment
h. For Air Drop Test when required:

1) Suitable aircraft
2) Suitable test site
3) Accelerometers

4. REFERENCES

A. 30 CFR 11, Code of Federal Regulations: Title 30--Mineral Resources: Part II--Self-Contained Breathing Apparatus.
B. USATECOM Regulation 385-6, Verification of Safety of Materiel During Testing.
C. TD MED 223, Respiratory Protective Devices.
D. AR 705-2, Research and Development of Materiel, Documenting Test Plans and Reports.
E. AMCR 385-224, Safety-AMC Safety Manual.
F. AR 750-6, Maintenance of Supplies and Equipment: Maintenance Planning, Allocation, and Co-ordination.
G. MIL-STD-105, Sampling Procedures and Tables for Inspection by Attributes.
H. MIL-STD-803, Human Engineering Criteria for Aerospace Systems and Equipment: Part I--Ground Equipment.
I. MIL-STD-810B, Environmental Test Methods.
J. MIL-B-51071, Breathing Apparatus, Compressed Air.
K. MTP 7-1-002, Air Portability and Airdrop Service Testing.
L. MTP 7-2-509, Airdrop Capability of Material (General).
M. MTP 8-2-110, Masks, Protective.
N. MTP 8-2-500, Receipt Inspection.
O. MTP 8-2-503, Rough Handling and Surface Transport.
P. MTP 8-2-511, Leak Testing of Protective Equipment.
Q. MTP 8-4-004, Long-Term Surveillance/Environmental Testing of CBR Muntions, Weapons, and Equipment.

5. SCOPE

5.1 SUMMARY

The procedures prescribed by this MTP are divided into a series of subtests, the sequence of which may be modified by the test plan. The receipt inspection subtest must be performed first to ascertain the condition of test items as received from their manufacturer; the safety statement should be verified next to reveal any unforeseen hazards; destructive tests should be performed last to obtain the most data from each test item. In preparing the test plan, consideration should be given to the number of test items available; their susceptibility to damage by particular subtests; the time, facilities and budget available; and the reliability and confidence limits established for the test item by design requirements. Subtests deemed most critical should be performed early in the test program so that the developing agency may have the earliest possible notice of deficiencies.

The following subtests comprise the complete test procedure.

a. Receipt Inspection - An inspection of the test item as received

from its manufacturer (1) to determine its physical characteristics and condition, (2) to detect manufacturing defects, and (3) to identify damage sustained during storage and shipment.

b. Safety Evaluation Tests - The objectives of these tests are to (1) insure that adequate safety features have been invorporated in the test item's designs, (2) verify the safety statement issued by the developing agency, and (3) obtain data to be included in the safety release recommendation required by reference 4B (USATECOM Regulation 385-6).

c. Simulated Environmental Testing - An evaluation to determine the test item's functional suitability under various environmental conditions, such as cyclic storage, temperature extremes, fungus, humidity, dust, sunshine, water immersion, salt fog, rain, and oxidizing agents.

d. Rough Handling and Surface Transport Tests - An evaluation to determine the effects of rough handling and surface transport on the physical and operational characteristics of the test item.

e. Air Transportability - An evaluation to determine the ease of loading and unloading the equipment on and from aircraft.

f. Airdrop Capability - An evaluation to determine to what extent airdropping the breathing apparatuses affects their operational characteristics.

g. Leak Tests - An evaluation to determine whether the test item leaks when subjected to certain standard conditions.

h. Operational Tests - A series of tests to determine whether the test item possesses the desired operating characteristics.

i. Maintenance Aspects - An evaluation to determine the test item's ease of maintainability.

j. Human Factors Evaluation - An evaluation to determine if the test item has been designed to be carried and used without excessive difficulties.

5.2 LIMITATIONS

The subject commodities are not usually intended for protection against chemical, biological, or radiological (CBR) agents, so CBR testing will be omitted; however, if in the future CBR protection becomes a requirement of this type of system, then the procedures of MTP 8-2-110 must be compiled with. Oxygen-generating breathing apparatuses, field protective masks; and respirators are beyond the scope of this MTP.

## 6. PROCEDURES

### 6.1 PREPARATION FOR TEST

#### 6.1.1 Prescheduling Conditions

The test officer will verify the receipt of the test items and will determine the proper sequence of the various subtests in his test plan according to reference 4D (USATECOM Regulation 705-2). The number of items that will be subjected to each test will be as specified by the procuring agency or in accordance with reference 4G (MIL-STD-105), or the minimum specified under test conduct.

The availability of the required equipment and facilities will be

ascertained before test. All instrumentation will be calibrated and certified prior to use.

6.1.2 Safety Statement

The test officer will insure that a safety statement has been received from the developing agency before testing is initiated and that it is understood by all test personnel. The safety statement includes information pertaining to the test item's operational limitations and specifies hazards peculiar to the item or components which are to be tested.

6.1.3 Safety

a. The test officer will acquaint himself with all possible safety hazards that could threaten personnel safety. Preliminary safety evaluation tests should be performed if the test officer feels these are necessary before the safety of the test to personnel can be verified. All support and test personnel involved must be physically fit and will be informed of hazards associated with the tests. All oxygen transfers will be made in a well ventilated no smoking area. The area will be clearly marked. Fire fighting, resuscitation, and safety equipment will be available and in readiness during all tests.

b. If oxygen is used as the breathing gas, care must be exercised to insure that oil, grease, or dirt does not enter the oxygen cylinder, connectors, or lines, during testing. Explosions have occurred under flow conditions where oxygen and grease have come in contact. This danger does not exist when compressed air is used as the breathing medium.

c. Oxygen should never be used in an apparatus designed for compressed air or vice versa. The manufacturer must clearly identify the gas to be used in each apparatus. It should be a durable, permanent identification to eliminate field mistakes. Manufacturers of some compressed air/oxygen self-contained breathing apparatuses make the air and oxygen systems similar to each other in appearance, and care must be exercised to use the proper gas when charging the system.

6.1.4 Security

Military and civilian test personnel associated with the tests will have the proper security clearance. All classified documents will be clearly marked, and proper security precautions will be observed.

6.1.5 Logistical Requirements

Prior to the conduct of any subtest, the test officer will insure that all logistical requirements are satisfied.

6.2 TEST CONDUCT

6.2.1 Receipt Inspection

The test item will be subjected to the applicable procedures of MTP

8-2-500 following its arrival at the test site, with emphasis on the following:

a. Visually inspect the test item package and record the following:

1) Damage (broken seals, dents, punctures, etc.)
2) Presence of waterproofing tape, if required
3) Rust or corrosion of metal
4) Illegible or missing markings
5) Incorrect labeling

b. Visually inspect the test items and record all deficiencies, specifically the following where applicable:

1) Missing components and associated parts such as the antidim set, winterization set, technical manual, instruction sheets, and necessary tools.
2) Incorrect assembly of components.
3) Condition of protective finishes.
4) Cracked or scratched lenses.
5) Deteriorated or cracked rubber parts or seals.
6) Corrosion of any metal parts.
7) Fasteners, slides, or clasps inoperative or corroded.
8) Proper identification and color coding of compressed gas cylinders.

c. Number serially and identify each test item to be used.
d. Determine and record the following:

1) External dimensions and weight of packaged item
2) External dimensions and weight of test item

e. Subject the test item to the applicable leak test procedures of paragraph 6.2.7.
f. Determine the operating characteristics of the test item by subjecting it to the applicable procedures of paragraph 6.2.8.
g. Photograph the defactive items.

6.2.2 Safety Evaluation Tests

6.2.2.1 High-Pressure Safety Relief Test

Check the high-pressure relief valve or similar safety device for proper operation as follows:

a. Remove the existing pressure gage from its location on the air/oxygen breathing apparatus, and replace it with a calibrated pressure gage graduated from 0 to 3000 psig or a gage which has sufficient pressure indicating capacity for the system being tested. Each scale division must be no more than 50 psig.
b. Fill the apparatus with the applicable gas or suitable substitute

until the safety valve operates.

NOTE: The relief valve setting will be indicated in the QMR, SDR, or other technical requirements. The cylinder should not be pressurized at more than 150 percent of the rated operating pressure of the cylinder. If the safety valve does not operate at this pressure, discontinue test.

c. Record the following:

1) Test equipment used and calibration data.
2) The maximum system pressure specified in QMR, SDR, or other technical requirements.
3) Cylinder charging pressure.
4) Safety valve relief pressure (in psig).
5) Any malfunctions of the system.

6.2.2.2 Low-Pressure Safety Relief Test

a. Test the low-pressure safety valve or other device which protects the breathing circuit from excessive pressure by allowing the pressure in the low-pressure hose assembly to rise to 150 psi or to the maximum as specified in QMR, SDR, or other technical requirements and determining that the low-pressure safety valve vents freely at this pressure.

b. Determine the closing pressure of the low pressure safety valve by reducing the system pressure in appropriate small increments until the safety valve closes at low pressure operating point. Verify conformance with specified operating requirements as described in applicable QMR, SDR, or other technical requirement.

c. At a pressure of approximately 20 psi above the closing pressure of the valve, check for valve leakage. Permissible leakage rates will be specified in procurement specifications.

d. Record the following:

1) Capability of system to vent freely at 150 psi.
2) The pressure (psig) at which the low-pressure safety valve operated.
3) Valve leakage rates, when applicable.
4) Any difficulties encountered during testing.

6.2.2.3 Cylinder Pressure Test

a. Pressurize hydraulically the air/oxygen (liquid oxygen included) cylinders at 200 percent of their maximum operating pressure, or as specified in the requirements. Verify the structural integrity of the cylinder.

b. Record any cylinder expansion, leakage or damage.

6.2.2.4 Remaining-Service-Life Indicator

a. Unless otherwise directed, verify during the operational tests of paragraph 6.2.8, the proper operation of the remaining-service-life indicator

as follows:

NOTE: If the service-life indicator depends on gas flow, the maximum flow rate of gas vented to the atmosphere that is used to operate such a device must not exceed the value specified in the QMR, SDR, or other technical requirements.

1) Connect the audible alarm, through a tube as required to an apparatus designed to collect and measure gas volumes under water.
2) Measure the amount of vented gas at specified system operating pressures and time intervals.

b. Determine and record the following:

1) System pressure when alarm sounds.
2) System pressure when alarm ceases to be audible.
3) The flow rate (liters/minute) at operating system pressures corresponding to the pressure at which the alarm operates.
4) The distance at which the alarm is audible.
5) Total air/oxygen consumption to operate device (cubic feet).

6.2.2.5 Safety Release

a. Perform tests as required to verify all the safety aspects included in the safety statement prepared by the developing agency.

b. Collect data to be included in the safety release recommendation required by reference 4B (USATECOM Regulation 385-6).

6.2.3 Simulated Environmental Testing

6.2.3.1 Cyclic Storage

Subject the test item to the long-term storage test of MTP 8-4-004 or the following:

a. Subject the test item in its packing container to cycles of climatic extremes. A cycle shall consist of three weeks duration as follows: Successive one week tests at humid, low temperature, and high temperature. Chamber conditions for each climatic condition are as follows:

1) Humid Storage. The chamber shall be maintained at 113°F ± 2°F and 85% R.H. for the duration of the test.
2) Low Temperature Storage. The chamber shall be maintained at -65°F ± 2°F for the duration of the test.
3) High Temperature Storage. The chamber shall be maintained at 160°F ± 2°F for the duration of the test.

b. The test item shall be subjected to a minimum of three such cycles, or more if specified. Upon completion of each cycle, the container

and contents shall be examined for damage.

6.2.3.2 Extreme-Temperature Tests

Unless otherwise directed subject the test item to the following temperature tests:

6.2.3.2.1 Low-Temperature Test -

Place a minimum of test items in a test chamber, and perform the following:

a. Reduce the chamber temperature to -45.6°C (-50°F), maintain it at -45.6°C for a period of 72 hours, and then visually inspect the test items and record any damage.

b. Raise the chamber temperature to the test item's minimum operating temperature as established by design requirements, and maintain this temperature until stabilization is reached. If stabilization is attained in less than 24 hours, maintain temperature for a complete 24-hour interval. Perform the following:

NOTE: Stabilization, unless otherwise specified, is considered to be reached when the temperature of the test item does not change more than 2°C (3.6°F) per hour.

1) Visually inspect the test items, and record any damage.
2) Verify operability of 1/3 of the test items at its elevated temperature as described in the applicable procedures of paragraph 6.2.8.

NOTE: Operability tests should be accomplished within 15 minutes of removing the test items from the chamber.

c. Remove the items from the chamber. Bring them to room temperature and perform the following:

1) Visually inspect the test items, and record damage.
2) Subject 1/3 of the test items to the applicable leak test procedures of paragraph 6.2.7.
3) Verify the operability of the test items by subjecting the remaining test item(s) to the applicable procedures of paragraph 6.2.8.

6.2.3.2.2 High-Temperature Tests -

Place a minimum of 12 test items in a temperature chamber, and perform the following:

a. Adjust the temperature of the chamber to 71.7°C (160°F) at a relative humidity of 15 percent, and maintain these conditions for a minimum of 4

hours, then visually inspect the test items and record damge.

b. Adjust the chamber to the test item's maximum operating temperature and to a relative humidity of no more than 15 percent, and maintain these conditions for a minimum of 24 hours, then perform the following:

1) Visually inspect the test items, and record damage.
2) Remove 1/2 of the test items from the chamber and perform the following:

a) Subject 1/2 of the test items to the leak test procedures of paragraph 6.2.7.
b) Verify the operability of the test item by subjecting the remaining item(s) to the applicable procedures of paragraph 6.2.8.
c) Adjust the chamber to the local ambient temperature and humidity and perform the following:

(1) Visually inspect the test items and record any damage.
(2) Subject 1/2 of the items to the leak test of paragraph 6.2.7.
(3) Verify the operability of the test items by subjecting the remaining test items to the applicable procedures of paragraph 6.2.9.

6.2.3.3 Fungus Test

a. Subject a minimum of 9 test items to the procedures of Procedure I, Method 508; reference 41 (MIL-STD-810B).

b. At the completion of the exposure period perform the following:

1) Visually inspect the items, and record signs of corrosion.
2) Disassemble 1/3 of the test items, and inspect the components for presence of fungus.
3) Subject 1/3 of the test items to the applicable procedures of paragraph 6.2.7.
4) Verify the operability of the test items by subjecting the remaining test items to the applicable procedures of paragraph 6.2.8.

6.2.3.4 Humidity Test

a. Subject a minimum of 9 test items to Procedure I, Method 507, reference 41 (MIL-STD-810B).

b. At the completion of the cycling period, perform the following:

1) Visually inspect the items, and record signs of corrosion.
2) Disassemble 1/3 of the test items, and inspect the components for corrosion and deterioration.
3) Subject 1/3 of the test items to the applicable procedures of paragraph 6.2.7.
4) Verify the operability of the test items by subjecting the

remaining test items to the applicable procedures of paragraph 6.2.8.

6.2.3.5 Dust Test

a. Subject a minimum of 9 test items to exposure conditions of Procedure I, Method 510, reference 4I (MIL-STD-810B).

b. At the completion of the exposure period, perform the following:

1) Visually inspect the test items, and record surface damage.
2) Disassemble 1/3 of the test items, and inspect the components for damage and presence of dust.
3) Subject 1/3 of the test items to the applicable leak test procedures of paragraph 6.2.7.
4) Verify the operability of the test items by subjecting the remaining test items to the applicable procedures of paragraph 6.2.8.

6.2.3.6 Sunshine Test

a. Subject a minimum of 6 test items to Procedure I, Method 505, reference 4I (MIL-STD-810B).

b. At the completion of the exposure period, perform the following:

1) Visually inspect the test items, and record surface damage, such as deterioration of rubber and plastics.
2) Subject 1/2 of the test items to the applicable leak tests of paragraph 6.2.7.
3) Verify the operability of the test items by subjecting the remaining test items to the applicable procedures of paragraph 6.2.8.

6.2.3.7 Water Immersion Tests

a. Subject a minimum of 9 test items, in their packing cases, to the procedures of Procedure I, Method 512, reference 4I (MIL-STD-810B).

NOTE: If design requirements establish water depth, water temperature and time of immersion different from the standard procedure the test plan will so state.

b. At the completion of the immersion test, remove the test items from their containers, and perform the following:

1) Disassemble 1/3 of the test items, and inspect their components for evidence of water penetration.
2) Subject 1/3 of the test items to the applicable leak test procedures of paragraph 6.2.7.
3) Verify the operability of the test items by subjecting the remaining test items to the applicable procedures of para-

graph 6.2.8.

c. Repeat steps a and b for unpacked test items, as applicable when required by specifications.

6.2.3.8 Salt Fog Test

a. Subject a minimum of 9 test items to Procedure I, Method 509, reference 4I (MIL-STD-810B).

b. At the completion of the salt fog spray exposure, perform the following:

1) Rinse the test items with clear water.
2) Visually inspect the test items for the presence of corrosion.
3) Disassemble 1/3 of the test items, and inspect their components for evidence of water penetration and corrosion.
4) Subject 1/3 of the test items to the applicable leak tests of paragraph 6.2.7.
5) Verify the operability of the test items by subjecting the remaining items to the applicable procedures of paragraph 6.2.8.

6.2.3.9 Rain Test

a. Subject a minimum of 6 test items when required by specifications, to the procedures of Procedure I, Method 506, reference 4I (MIL-STD-810B).

b. At the completion of the rain exposure, perform the following:

1) Visually inspect the test items for the presence of corrosion and swelling.
2) Disassemble 1/2 of the test items, and inspect the components for evidence of water penetration, corrosion, and swelling.
3) Verify the operability of the test item by subjecting the remaining items to the procedures of paragraph 6.2.8.

6.2.3.10 Resistance to Oxides of Nitrogen

Determine the resistance of the test item to oxides of nitrogen according to the following procedure, unless otherwise stated in QMR, SDR, or other technical requirements.

NOTE: Safety requirements are contained in AMCR 385-224 Paragraph 1308 and 2209b (1), (a) through (c).

a. Place the unit, less carrying case, facepiece, and breathing tube in a confined space (9 cu. ft. max.) containing an open container holding 1 gallon of fuming nitric acid (sp. gr. 1.49 ± 0.01).

b. Seal any open part of the demand regulator, valves or similar type equipment with a cork or rubber stopper, when applicable. Test at a temperature of 21° ± 5°C (70° ± 10°F) and a relative humidity of 50 ± 5 percent.

Continue test for 24 hours. Remove the apparatus, wash and dry it, and examine it for the presence of pitting, corrosion, or visible damage.

c. Attach a fitting from the breather to the facepiece adapter of the breathing tube. Connect a pressure gage, calibrated from 0 to 3000 psig, to the filling port.

d. Open the filling port so that the gage measures the pressure in the cylinders; record the pressure.

e. Start the breather and record the demand suction at 2000 psig, at 400 psig, and at 150 psig.

NOTE: QMR, SDR, or other technical requirements will indicate the acceptable breathing suction through the breathing apparatus operating range. Do not vent the apparatus during the test period, but allow it to deflate by the action of the simulated breather.

f. The breather must have the capability of indicating the total resistance to breathing of the breathing apparatus less facepiece and meeting the following performance requirements:

1) Peak flow of 78 liters/minute.
2) Pump displacement of 1 liter.
3) Breathing cycle of 25 ± 1 strokes/min.
4) Back pressure on return stroke of 20 millimeters of water (max.).

g. Record the following:

1) Quantity and specific gravity of nitric acid.
2) Temperature and relative humidity of test chamber.
3) Duration of test.
4) Cleaning method used.
5) Pressure in cylinders, before and after test.
6) Breathing suction of apparatus at the various specified cylinder pressures while being depleted by mechanical breather.
7) Type of test apparatus used.
8) Any visible pitting, deterioration or damage to test item.

6.2.4 Rough Handling and Surface Transport Tests

a. Subject a minimum of 6 test items, packaged in their original containers, to the following procedures of MTP 8-2-503.

1) Vibration test of paragraph 6.2.2.2a.3
2) Transit drop test of paragraph 6.2.2.1a.2

b. At the completion of testing, perform the following:

1) Examine the test item's packaging for cracks, breaks, undone binding, etc.
2) Examine the test items for damage and deformation.

3) Subject 1/2 of the test items to the applicable leak tests of paragraph 6.2.7.
4) Verify the operability of the test item by subjecting the remaining test items to the applicable procedures of paragraph 6.2.8.

6.2.5 Air Transportability

Determine the ease of loading and unloading the test items from an aircraft as described in the applicable sections of MTP 7-2-515 or as follows:

NOTE: Background information on air transportability is contained in reference L (MTP 7-1-002).

a. Load the test items, in their shipping containers, aboard a typical cargo aircraft or simulated aircraft, using current standard loading equipment, and record the following:

1) Type of aircraft used or simulated
2) Shipping container length, width, height, weight, and material
3) Equipment used for loading
4) Difficulties encountered while loading
5) Method of tiedown
6) Damage sustained by the package during loading

b. Unload the test items from the aircraft or simulated aircraft, and record the following:

1) Equipment used in unloading
2) Difficulties encountered while unloading

6.2.6 Airdrop Capability

Subject a minimum of 6 test items, packaged in their original containers, to the applicable sections of MTP 7-2-509 as follows:

a. Rig the test containers, with attached accelerometers, to the appropriate airdrop containers, and drop the containers from typical aircraft as instructed by the referenced MTP. Record the following:

1) Aircraft type(s) used
2) Aircraft airspeed
3) Altitude
4) Meteorological conditions
5) Impact velocities
6) Deceleration magnitude at impact in g's

b. Cover the airdrop test procedures with still and motion cameras.
c. At completion of the test, perform the following:

1) Examine the test item's packaging for breaks, undone bindings,

etc.

2) Examine the test item for damage and deformation.
3) Subject a suitably determined number of the items to the leak tests of paragraph 6.2.7.
4) Verify the operability of the test items by subjecting the remaining items to the procedures of paragraph 6.2.8.

6.2.7 Leak Tests

Subject the test item to the applicable procedures of MTP 8-2-511 and the following:

NOTE: 1. If additional tests are considered appropriate they shall be specified on the test plan.
2. For background information on testing breathing apparatuses, see reference 4J (MIL-B-51071).

6.2.7.1 Backpack-and-Harness and Hose-and-Regulator Groups

Subject the test item's demand regulator, breathing hose, cylinders, and fittings to the following leak tests as applicable:

a. Connect a water manometer by means of a tee and a proper fitting to the facepiece adapter and the breathing tube, and attach a source of vacuum with a shutoff valve to the other end of the tee. Increase the vacuum gradually until the demand valve opens. Read the manometer at the instant the valve opens. Shut off air or oxygen at the pressure regulator, and exhaust residual air or oxygen from the low-pressure hose, the demand regulator, and the breathing tube until the manometer reads 2 inches ± 1/2 inch of water or as specified in QMR, SDR, or other technical requirements. Close the valve to the vacuum source. Failure of the manometer to maintain the level for a minimum of 10 seconds indicates leakage in the breathing tube assembly.

b. Disconnect the breathing tube, and connect the manometer by means of a tee to the exit side of the demand regulator. Turn on the air or oxygen at the pressure regulator, and seal off the exit end of the tee. A change in water level indicates a leak.

c. Connect the facepiece end of the breathing tube to a flow meter, and draw air or oxygen at 150 liters per minute or as specified in QMR, SDR, or other technical requirements, when fully charged, from the regulator. Read and record the manometer.

d. Pressurize the apparatus less facepiece and breathing tube. Immerse the apparatus in water, being careful not to wet the demand regulator. Emission of bubbles indicates leakage. Brush the connection between the low-pressure hose and demand regulator with soap solution. Persistent bubbling indicates leakage.

e. Subject the air/oxygen cylinders to a hydrostatic pressure equal to 150 percent of the actual working pressure. The working pressure will be as indicated in the QMR, SDR, or other technical requirements. The cylinders will be held at this pressure and at a temperature of 21° ± 5°C (70° ± 10°F) for a period of one hour. Any decrease in pressure during the one-hour period will be reported. If the cylinders show no leakage, they will be recharged to the

system pressure. Care must be exercised to insure that no combustible contaminants (oil, or grease) enter the oxygen cylinder during testing.

6.2.7.2 Facepiece Group

Determine the pressure of mask leakage resulting from defective outlet valves, imperfect peripheral seal or defective faceplate fabrication as described in the applicable sections of MTP 8-2-511 or by mounting the mask on the dummy head of a mechanical breather, and performing the following:

a. Determine the existence of fabrication defects and peripheral mask leaks.

b. Determine gas penetration using a dioctyl phthalate (DOP) filter testing penetrometer.

c. Test for carbon dioxide in inspired gas by measuring the concentration of the gas at the mouth. The maximum allowable concentrations will be specified in QMR, SDR, or other technical specifications.

d. Measure the inhalation and the exhalation resistance of the air breathing apparatus. Record the pressure differential across the mask required to sustain flows of various magnitudes.

e. Measure the leakage of the outlet valve.

f. Measure the ambient air temperature. Repeat the tests at low and high air temperatures as specified in the requirements.

g. Record the following test data:

1) Gas mask peripheral leaks and other fabrication defects.
2) Dioctyl phthalate (DOP) penetration subtest:

   a) Breathing rate (respirations per minute)
   b) Temperature and relative humidity
   c) Quantity of DOP entering mask (percent by volume)
   d) Breathing volume (in liters)
   e) Fogging or hazing of eyepieces

3) Pressure differential at mask mouthpiece (inches of water for various air/oxygen flow rates (liters/min.).
4) Inhalation/exhalation resistance of inhalation and exhalation valve:

   a) Breathing rate (respirations per minute)
   b) Breathing volume (liters)
   c) Air/oxygen flow rates (liters/minute)

5) Outlet valve resistance and leakage:

   a) Air/oxygen flow rate (liters/minute)
   b) Pressure differential across valve (inches of water)
   c) Leakage with zero flow rate
   d) Acceptability of the test items' outlet valve

6) Amount of carbon dioxide in inspired air:

a) Breathing rate.
b) Breathing volume.
c) Temperature and relative humidity during test.
d) Carbon dioxide (percent by volume) in inspired air, at the mouth.
e) Volume percentage of carbon dioxide in air which is induced into the system.
f) Temperature of inspired air.

6.2.7.3 Man Tests

a. A minimum of three suitably trained personnel with fully charged breathing apparatuses will enter a test chamber maintained at 41°C (105°F) and a relative humidity of 85 percent, or at other conditions specified in the design requirements. The chamber will contain a low concentration of nontoxic chemical agent. The personnel will conduct the test in three phases for the full duration of the air/oxygen supply, as follows:

1) While resting and wearing the air breathing device
2) While walking and wearing the air breathing device
3) While working and wearing the air breathing device

b. Record the following:

1) Chamber temperature and relative humidity.
2) Number of persons in the test.
3) Duration of test (min.).
4) Type of activity of test personnel during test.
5) Difficulties in vision encountered by test personnel.
6) Breathing difficulties or discomfort experienced by test personnel.
7) Nontoxic chemical agent used in chamber and its concentration.
8) Unusual odors or tastes experienced by test personnel during test.
9) The total number of defective masks.
10) Temperature of the inspired air if an exothermic regeneration system is used.

6.2.8 Operational Tests

Subject the test item to the applicable operational test(s) described below and to all other tests specified by the test plan.

6.2.8.1 Simulated Operation

a. Verify the test item's operability by subjecting the test item to the following procedures:

1) Verify that the high-pressure relief valve is operative by pressurizing cylinders until valve operates.

NOTE: If valve does not operate before 3000 psi, discontinue test.

2) Adjust pressure of the air/oxygen cylinders to the system pressure specified on equipment specifications.

NOTE: For low- or high-temperature environmental tests, perform high-pressure relief test before subjecting test item to the environmental temperature.

3) Allow the test item to stabilize at the temperature, pressure and relative humidity specified in the requirements or test plan.
4) Mount the facepiece on the dummy head of a mechanical breather that is capable of producing 24 respirations/min at a rate of 40 liters a minute; work rate will be specified by equipment specifications.
5) Measure the cylinder pressure by using a pressure gage whose fine graduations represent no more than 50 psig. This gage can usually be mounted to the cylinders by using a suitable tee. The pressure gage range should be from 0 to 3000 psig or as specified by equipment specifications.
6) Start the mechanical breather, and measure the inhalation resistance to air flow at the facepiece.
7) With the mechanical breather operating, measure the exhalation resistance at the facepiece.
8) On combination-type (open or closed circuit) air/oxygen breathing apparatuses, perform static air flow measurements at specified cylinder pressures and record the air flow rates at each specified pressure.
9) Check the safety pressure relief valve in the breathing circuit for proper operation.
10) Operate breather until service life indicator is actuated. Record remaining pressure of air/oxygen cylinders as service life indicator is actuated.
11) Check the bypass valve for proper operation, when applicable.
12) Correct for the air flow resistance in the hose connecting the breathing apparatus and automatic breather if significant.

b. Record the following for each test performed:

1) Ambient temperature, pressure, and relative humidity.
2) Respiration rate (number/min).
3) Flow rate of air/oxygen at standard conditions.
4) Power rate of breather (kg-m/min).
5) High-pressure setting of safety relief valve (psi).
6) Cylinder operating pressure (psi).
7) Inhalation resistance (inches of water).
8) Exhalation resistance (inches of water).
9) Air flow at various system pressures (liters/min) for combination type air/oxygen breathing apparatuses.

10) Pressure at which breathing circuit pressure relief valve opens.
11) Air/oxygen system pressure when service life indicator is actuated.
12) Malfunction in the bypass valve operation.
13) Corrections or repairs made during the test.
14) Duration of test.

6.2.8.2 Chamber Man Test - Tropic Environment

a. Have a minimum of three trained personnel don fully charged breathing apparatuses and enter a tropic test chamber maintained at 35°C (95°F) and 85 percent humidity or at other conditions specified by the test plan or materiel requirements. Perform the test in three phases, utilizing the entire air/oxygen supply of each test item for each phase as follows:

1) Personnel using the breathing apparatus while resting.
2) Personnel using the breathing apparatus while walking.
3) Personnel using the air/oxygen breathing apparatus while running and crawling.

b. Recharge the air/oxygen cylinders with the proper gas after each phase.

c. Check the audible warning device for proper operation, as applicable.

NOTE: Depletion of the oxygen supply is indicated by the pressure gage and termination of the audible flow.

d. Record the following:

1) Temperature of air entering the breathing apparatus as measured by a thermocouple in the breathing hose.
2) Evidence of oxygen starvation, hyperoxygenation or other adverse health effects sustained by the test personnel during the conduct of the test, as observed by a medical officer.
3) The medical officer's narrative report on the adequacy and safety of the breathing apparatus.
4) A complete description of equipment malfunctions or difficulties encountered in the conduct of the test.
5) Duration for which each breathing system was usable, in each phase.
6) Stature, physical training status, and acclimatization of each person and the weights and type of clothing, shoes and equipment carried.

6.2.8.3 Chamber Man Test - Oxygen-Depleted Atmosphere

a. Introduce nitrogen into test chamber until the oxygen present is not sufficient to support combustion of a candle.

NOTE: The nitrogen should create a slight overpressure to prevent

ingress of air into the chamber.

b. Repeat the procedures of paragraph 6.2.8.2 in their entirety or in part, as determined by the test plan.

6.2.9 Maintenance Aspects

a. Determine the maintenance characteristics of the test item by performing complete maintenance on the test item as prescribed in the item's maintenance manual and in reference 4F (AR 750-6).

b. Record the following:

1) Ease of maintenance.
2) Need for special tools or skills.
3) Interchangeability of components.
4) Adequacy and accuracy of the maintenance instructions provided by the manufacturer.
5) Time required to perform maintenance tasks.
6) Maintenance category of the test item.

c. Obtain and retain in the test file motion pictures showing assembly and disassembly of test items and repair operations performed.

6.2.10 Human Factors Evaluation

a. Determine the ease of usage and the functional effectiveness of the test item when employed by test personnel representing the ninety-fifth percentile of the Army population. See reference 4H (MIL-STD-803).

b. Record the following for each test item:

1) Type of equipment and clothing worn.
2) Ease of donning apparatus.
3) Time required to don mask, in seconds.
4) Ease of breathing.
5) Comfort of equipment and adequacy of mask fit.
6) Intelligibility of speech transmission if the apparatus is equipped with a voice-emitting capability.
7) Compatibility of breathing apparatus with the clothing and equipment worn.
8) Visibility (with and without optical lenses) at environmental conditions, when applicable.
9) Any comments on problems affecting the use or effectivenss of the breathing apparatus, such as fit of masks and ease of replacing filter and cartridge elements.

c. Obtain still or motion photographs where necessary.

6.3 TEST DATA

6.3.1 Receipt Inspection

a. Record the following:

1) Data collected as recorded in the applicable sections of MTP 8-2-500.
2) For the test item package:

a) Indications of damage
b) Presence of waterproofing tape
c) Rust or corrosion of metal
d) Illegible or missing markings
e) Incorrect labeling
f) External weight and dimensions

3) For the test item:

a) Missing components.
b) Incorrect assembly.
c) Defective or deteriorated protective finish.
d) Cracked or scratched lenses.
e) Deteriorated or cracked rubber parts or seals.
f) Corrosion of any metal parts.
g) Inoperative or corroded fasteners, slides or clasps.
h) Improper identification and color coding of compressed gas cylinders.
i) External weight and dimensions.
j) Leakage data as described in paragraph 6.2.7.
k) Operability data as described in paragraph 6.2.8.

b. Retain all photographs.

6.3.2 Safety Evaluation Tests

6.3.2.1 High-Pressure Safety Relief Test

Record the following:

a. Test equipment used and calibrated data
b. Maximum specified system pressure
c. Cylinders charging pressure
d. Safety valve relief pressure in PSIG
e. Any malfunction of the system

6.3.2.2 Low-Pressure Safety Relief Test

Record the following:

a. Capability of the system to vent freely at 150 PSI
b. Pressure at which valve operated in (PSIG)
c. Valve leakage rates, as applicable
d. Difficulties encountered during testing

6.3.2.3 Cylinder Pressure Test

Record the following:

a. Any cylinder expansion
b. Leakage
c. Damage

6.3.2.4 Remaining-Service-Life Indicator

Record the following:

a. System pressure when alarm sounds.
b. System pressure when alarm ceases to be audible.
c. Flow rates at maximum and minimum alarm operating pressures in liters per minute.
d. Distance at which alarm is audible in feet.
e. Total air/oxygen consumption to operate alarm in cubic feet.

6.3.2.5 Safety Release

Record the data collected for inclusion in Safety Release Recommendation as required by USATECOM Regulation 385-6.

6.3.3 Simulated Environmental Testing

6.3.3.1 Cyclic Storage

Record the following:

a. Test performed (cyclic storage, low, temperature storage)
b. Test item identification number
c. Cycle number
d. Damage to:

    1) Container
    2) Test item

6.3.3.2 Extreme-Temperature Tests

6.3.3.2.1 Low-Temperature Test -

Record the following for each test item:

a. Test item identification number
b. For temperature of -45.6°C (-50°F):

    1) Damages incurred

c. For minimum operating temperature:

1) Temperature in °C
2) Damages incurred
3) Operability data collected as described in paragraph 6.2.8

d. For ambient temperature:

1) Temperature in °C
2) Test item damage
3) Leakage data collected as described in paragraph 6.2.7
4) Operability data collected as described in paragraph 6.2.8

6.3.3.2.2 High Temperature Test -

Record the following for each test item, as applicable:

a. Test item identification number
b. For temperature of 71.7°C (160°F):

1) Damages incurred

c. For test item maximum operating temperature:

1) Temperature in °C
2) Damages incurred
3) Leakage data collected as described in paragraph 6.2.7
4) Operability data collected as described in paragraph 6.2.8

d. For ambient temperature:

1) Temperature in °F
2) Damage incurred
3) Leakage data collected as described in paragraph 6.2.7
4) Operability data collected as described in paragraph 6.2.8

6.3.3.3 Fungus Test

Record the following for each test item:

a. Test item identification number
b. Presence of fungus on:

1) Test item
2) Test item components

c. Leakage data collected as described in paragraph 6.2.7
d. Operability data collected as described in paragraph 6.2.8

6.3.3.4 Humidity Test

Record the following for each test item:

a. Test item identification number

b. Evidence of corrosion on:

1) Test item
2) Test item components

c. Operability data collected as described in paragraph 6.2.8
d. Leakage data collected as described in paragraph 6.2.7

6.3.3.5 Dust Test

Record the following for each test item:

a. Test item identification number
b. Damage to:

1) External surface
2) Test item components

c. Presence of dust on test item components
d. Leakage data collected as described in paragraph 6.2.7
e. Operability data collected as described in paragraph 6.2.8

6.3.3.6 Sunshine Test

Record the following for each test item:

a. Test item identification number
b. Damage to:

1) External surface
2) Test item components

c. Leakage data collected as described in paragraph 6.2.7.
d. Operability data collected as described in paragraph 6.2.8

6.3.3.7 Water Immersion Tests

Record the following for each test item, as applicable:

a. Test item identification number
b. Test item condition (packaged, unpackaged)
c. During immersion:

1) Depth of water over container, in inches
2) Water temperature, in °F
3) Presence of bubbling, if any
4) Immersion time to bubbling, if any, in minutes
5) Total immersion time, in minutes

d. For the test item:

1) Presence of corrosion:

a) Test item
b) Test item components

2) Presence of water penetration
3) Leakage data collected as described in paragraph 6.2.7
4) Operability data collected as described in paragraph 6.2.8

6.3.3.8 Salt Fog Test

Record the following for each test item, as applicable:

a. Test item identification number
b. Evidence of corrosion:

1) Test item
2) Test item components

c. Evidence of water penetration
d. Leakage data collected as described in paragraph 6.2.7
e. Operability data collected as described in paragraph 6.2.8

6.3.3.9 Rain Test

Record the following for each test item, as applicable:

a. Test item identification number
b. Presence of corrosions and swelling

1) Test item
2) Test item components

c. Evidence of water penetration
d. Operability data collected as described in paragraph 6.2.8

6.3.3.10 Resistance to Oxides of Nitrogen

Record the following:

a. Quantity and specific gravity of nitric acid.
b. Temperature and relative humidity of test chamber.
c. Duration of test.
d. Cleaning method used.
e. Pressure in cylinders, before and after test.
f. Breathing suction of apparatus at the various specified cylinder pressures while being depleted by mechanical breather.
g. Type of test apparatus used.
h. Any visible pitting, deterioration or damage to test item.

6.3.4 Rough Handling and Surface Transport Test

Record the following for each test item, as applicable:

a. Test item identification number
b. Data collected as described in applicable sections of MTP 8-2-503
c. Evidence of damage to the test item package
d. Evidence of damage and deformation to the test item
e. Leakage data collected as described in paragraph 6.2.7
f. Operability data collected as described in paragraph 6.2.8

6.3.5 Air Transportability

Record the data collected in the applicable sections of MTP 7-2-515 or the following:

a. Type of aircraft used or simulated
b. Shipping container:

    1) Length, width and height, in inches
    2) Weight, in pounds
    3) Material

c. Equipment used in loading
d. Difficulties encountered while loading
e. Method of tie-down
f. Damage incurred to the package while loading
g. Equipment used in unloading
h. Difficulties incurred in unloading

6.3.6 Air Drop Capability

a. Record the following for each test item:

    1) Test item identification
    2) Aircraft used
    3) Aircraft air speed
    4) Air conditions (calm, turbulent)
    5) Altitude
    6) Test item impact velocity in fps
    7) Deceleration force of impact in G's
    8) For test item package:

        a) Presence of cracks, breaks, etc.
        b) Undone binding

    9) For test item:

        a) Damage or deformities
        b) Leakage data collected as described in paragraph 6.2.7
        c) Operability data collected as described in paragraph 6.2.8

b. Retain all motion and still pictures

6.3.7 Leak Tests

Record data collected as described in the applicable sections of MTP 8-2-511 and the following:

6.3.7.1 Backpack-and-Harness and Hose-and-Regulatory Groups

Record the following:

a. For faceplate adapter and breathing tube:

1) Manometer reading when demand valve opens in inches of water
2) Evidence of leakage

b. Evidence of leakage in demand regulator
c. For breathing tube:

1) Manometer reading when drawing air or oxygen at 150 liters per minute.
2) Evidence of leakage.

d. Evidence of leakage between low pressure hose and demand regulator
e. For air/oxygen cylinders:

1) Test item working pressure in psi
2) Evidence of leakage

6.3.7.2 Facepiece Group

Record the following:

a. Gas mask peripheral leaks and other fabrication defects
b. For dioctyl phthalate (DOP) penetration subtest:

1) Breathing rate (respirations per minute)
2) Temperature and relative humidity
3) Quantity of DOP entering mask (percent by volume)
4) Breathing volume (in liters)
5) Fogging or hazing of eyepieces

c. Pressure differential at mask mouthpiece (inches of water) for various air/oxygen flow rates (liters/min).
d. Inhalation/exhalation resistance of inhalation and exhalation valve:

1) Breathing rate (respirations per minute)
2) Breathing volume (liters)
3) Air/oxygen flow rates (liters/minute)

e. Outlet valve resistance and leakage:

1) Air/oxygen flow rate (liters/minute)
2) Pressure differenital across valve (inches of water)
3) Leakage with zero flow rate

4) Acceptability of the test items' outlet valve

f. Amount of carbon dioxide in inspired air:

1) Breathing rate.
2) Breathing volume.
3) Temperature and relative humidity during test.
4) Carbon dioxide (percent by volume) in inspired air, at the mouth.
5) Volume percentage of carbon dioxide in air which is induced into the system.
6) Temperature of inspired air.

6.3.7.3 Man Tests

Record the following:

a. Chamber temperature in °C and relative humidity in %.
b. Number of persons in the test.
c. Duration of test (min).
d. Type of activity of test personnel during test.
e. Difficulties in vision encountered by test personnel.
f. Breathing difficulties or discomfort experienced by test personnel.
g. Nontoxic chemical agent used in chamber and its concentration.
h. Unusual odors or tastes experienced by test personnel during test.
i. The total number of defective masks.
j. Temperature, in °C, of inspired air if an exothermic regeneration system is used.

6.3.8 Operational Test

6.3.8.1 Simulated Operation

Record the following:

a. Ambient temperature, in °C, pressure, in inches of Hg and relative humidity in %.
b. Respiration rate (number/min).
c. Flow rate of air/oxygen at standard conditions in cubic feet/min.
d. Power rate of breather (kg-m/min).
e. High-pressure setting of safety relief valve (psi).
f. Cylinder operating pressure (psi).
g. Inhalation resistance (inches of water).
h. Exhalation resistance (inches of water).
i. Air flow at each system pressure (liters/min)for combination type test items.
j. Pressure at which breathing circuit pressure relief valve opens.
k. Air/oxygen system pressure when service life indicator is actuated.
l. Malfunction in the bypass valve operation.
m. Corrections or repairs made during the test.
n. Duration of test.

6.3.8.2 Chamber Man Test - Tropic Environment

Record the following for each activity performed:

a. Activity performed (resting, walking, running and crawling).
b. Temperature of air entering the breathing apparatus as measured by a thermocouple in the breathing hose, in °F.
c. Evidence of oxygen starvation, hyperoxygenation or other adverse health effects, as observed by a medical officer.
d. The medical officer's narrative report on the adequacy and safety of the breathing apparatus.
e. A complete description of equipment malfunctions or difficulties encountered in the conduct of the test.
f. Duration for which each breathing system was usable, in each phase.
g. Stature, physical training status, and acclimatization of each person and the weights and type of clothing, shoes and equipment carried.

6.3.8.3 Chamber Man Test - Oxygen - Depleted Atmosphere

Record the data collected as described in the applicable sections of paragraph 6.2.8.2.

6.3.9 Maintenance Aspects

a. Record the following:

1) Ease of maintenance.
2) Need for special tools or skills.
3) Interchangeability of components.
4) Adequacy and accuracy of the maintenance instructions provided by the manufacturer.
5) Time required to perform maintenance tasks in minutes.
6) Maintenance category of the test item.

b. Retain all photographic records.

6.3.10 Human Factors Evaluation

a. Record the following for each test item:

1) Type of equipment and clothing worn.
2) Ease of donning respirator.
3) Time required to don mask, in seconds.
4) Ease of breathing.
5) Comfort of equipment and adequacy of mask fit.
6) Intelligibility of speech transmission if the respirator is equipped with a voice-emitting capability.
7) Compatibility of breathing apparatus with the clothing and equipment worn.
8) Visibility (with and without optical lenses) at environmental conditions, when applicable.

9) Any comments on problems affecting the use or effectiveness of the breathing apparatus, such as fit of masks and ease of replacing filter and cartridge elements.

b. Retain all photographic records

6.4 DATA REDUCTION AND PRESENTATION

6.4.1 Receipt Inspection

a. Data collected as a result of this procedure shall be presented as indicated in the applicable portions of MTP 8-2-500.

b. The description of the test item, number of items tested, and conditions upon receipt shall be presented in tabular form.

c. Results of the leak subtest shall be presented in narrative or other convenient form.

6.4.2 Safety Evaluation

a. A Safety Release Recommendation (USATECOM Regulation 385-6) shall be forwarded to the U. S. Army Test and Evaluation Command within 30 days of the beginning of the test. The Safety Release Recommendation shall contain the following information: special safety considerations or hazards to personnel and materiel (including developmental types of equipment as well as standard components used in assemblage of items being tested).

b. Data and comments relative to the safety hazards observed during any phase of testing.

c. Comments relative to suggested safety improvements.

6.4.3 Simulated Environmental Testing

a. The results of the subtests conducted shall be presented in tabular or other suitable form.

b. The results of the operational check tests performed at the conclusion of the various environmental tests shall be presented in narrative or other suitable form.

6.4.4 Rough Handling and Surface Transport

a. Rough handling and surface transport data shall be presented as prescribed in MTP 8-2-503.

b. Vibration and shock data shall be presented in tabular form to indicate test times, distances (dropped), shock levels, vibration frequencies, etc., and significant findings of the test. Include photographs of damage.

c. Present data on operation of test item after subjection to rough handling and surface transport, conditions, vibration and shock.

6.4.5 Air Transportability

a. The results of this subtest shall be presented as prescribed in MTP 7-1-002 and 7-2-515.

b. Air transport conditions will be reported in tabular or other convenient form.

c. Narrative comments, photos, etc., may be included if required.

6.4.6 Air Drop Capability

a. The results of the subtest shall be presented as prescribed in MTP 7-2-509 and include the following:

1) Type of aircraft
2) Air speed, altitude, and meteorological conditions
3) Packaging material condition after test
4) Maximum "G" force on opening of parachute and on impact

b. Present narrative comments and data regarding ease or difficulty encountered in accomplishing air drop. Present photographs (as required) to indicate results of air drop.

c. Present data on operation and performance of the test item after air drop capability subtest.

6.4.7 Leak Testing

a. The results of leak testing shall be presented as prescribed in MTP 8-2-511.

b. Narrative comments, photos, etc., shall be included, as required.

6.4.8 Operational Testing

Data derived from this subtest shall be presented in narrative form, supplemented by drawings, photographs, charts, tables, graphs, or any other suitable means of displaying information. The report shall clearly conclude whether the test item meets the reliability criteria established in applicable specifications. Recommendations relative to further testing and methods to overcome malfunctions shall also be included.

6.4.9 Maintenance Aspects

Data from this subtest shall be presented in narrative form. The report shall be supplemented by photos, drawings, or other devices to substantiate the conclusions and recommendations.

6.4.10 Human Factors Evaluation

a. Data from this subtest shall be presented in tabular, narrative, or other suitable form supplemented by photographs and graphic or art presentations as required.

b. A summary of comments regarding shortcomings and recommended improvements shall be presented.

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13. ABSTRACT

This Engineering Test Procedure describes test methods and techniques for evaluating the technical performance and characteristics of Self-Contained Air/Oxygen Supply Breathing Apparatuses, and for determining the suitability of these items to undergo test for service use by the U. S. Army. The evaluation is related to criteria established by applicable Qualitative Materiel Requirements (QMR), Small Development Requirements (SDR), Technical Characteristics (TC), or other appropriate design requirements and specifications.

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| Test Methods and Techniques | | | | | | |

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